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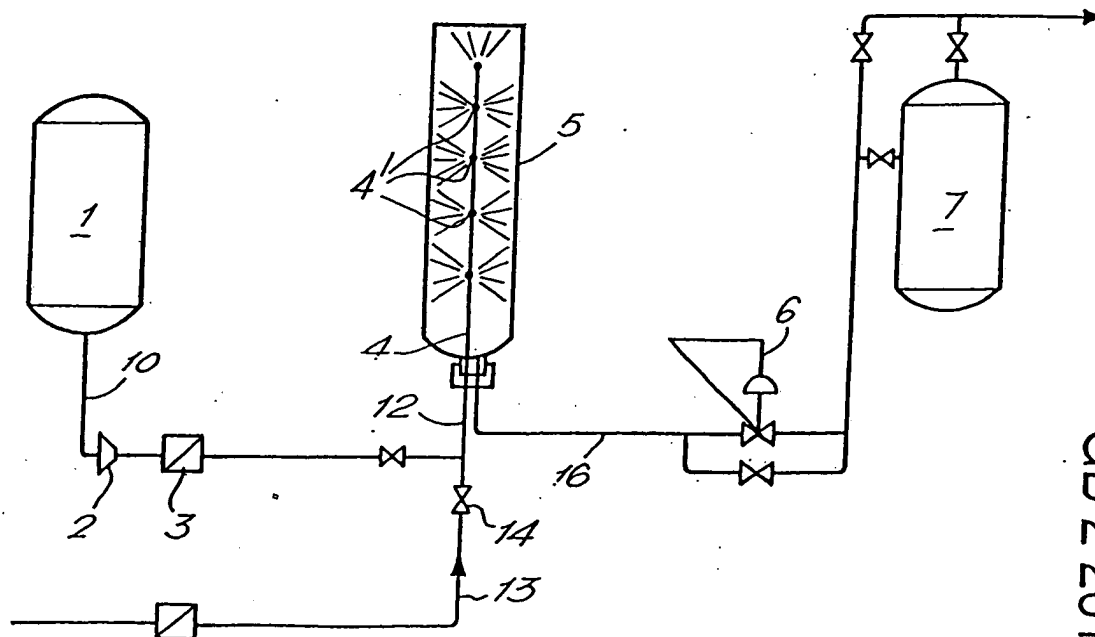
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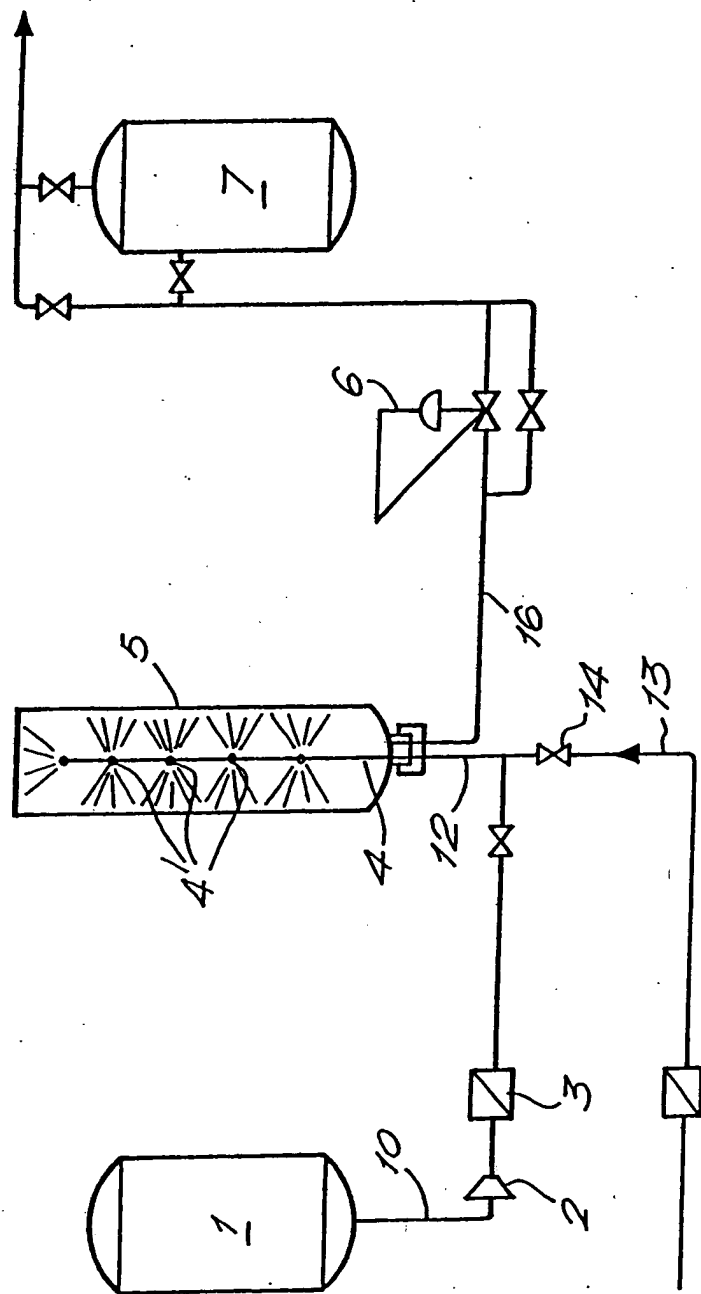
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(54) Method of cleaning containers

(57) The interior of a compressed gas cylinder 5 is cleaned by passing clean liquid carbon dioxide under pressure from a source tank 1 through nozzles 4' in a spray nozzle lance 4 located within the interior of the cylinder. The gas cylinder 5 is initially pressurised by liquid nitrogen via line 13. The contaminated liquid carbon dioxide is collected at tank 7.



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METHODS OF CLEANING CONTAINERS

The present invention relates to methods of cleaning the interior surface(s) of containers, for example, the interior surface(s) of cylinders which in use contain industrial, medical or other gases under pressure.

Currently, gas cylinders are cleaned by flushing them with hot deionised water and a solvent such as FREON (Registered Trade Mark). This known method of cleaning gas cylinders suffers from the following disadvantages:

- a) The method is relatively expensive; FREON is an expensive solvent;
- b) the solvent should it escape is claimed to be damaging to the environment; and
- c) introducing hot de-ionised water into the cylinder necessitates a drying step.

It is an aim of the present invention to provide a method of cleaning the interior surface(s) of a container using clean liquid carbon dioxide under pressure.

According to the present invention, a method of cleaning the interior surface(s) of a container comprises passing clean liquid carbon dioxide under pressure through at least one nozzle located within the container.

An embodiment of the invention will now be described by way of example, reference being made to the Figure of the accompanying diagrammatic drawing which is a schematic diagram of an apparatus for use in cleaning the interior of a container.

As shown, a line 10 extends initially from a source tank 1 of liquid carbon dioxide to a pump 2 and a filter 3. From the filter 3 the line 10 joins a line 12 which is connected at its upper (as shown) end with the lower (as shown) end of a spray nozzle lance 4. The spray nozzle lance 4

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is located within the interior of a container in the form of a compressed gas cylinder 5 and has a plurality of space nozzles 4' which extend along substantially the full length of the interior of the cylinder 5.

At its lower (as shown) end line 12 is connected to a line 13 in which is located a control valve 14.

Extending from the lower (as shown) end of the cylinder 5 is a further line 16 which communicates with a receiving tank 7. A pressure control device 6 is located within the line 16.

In use, initially the pressure within the cylinder is brought to about 40 bar by the slow introduction of nitrogen via line 13, valve 14, line 12 and the spray nozzle lance 4. The pressurisation of the cylinder 5 is intended to inhibit coating effects and the formation of dry ice.

Next, clean liquid carbon dioxide from tank 1 is pressurised by pump 2 and then passes through the filter 3 which removes any particulate material. The filtered liquid carbon dioxide under pressure then passes into the spray nozzle lance 4 via the line 12 and is sprayed through the nozzles 4' to achieve a uniform liquid spray. The liquid spray velocity and the solvent properties of the liquid carbon dioxide remove impurities from the internal surface(s) of the cylinder 5.

Contaminated liquid carbon dioxide leaves the interior of the cylinder 5 via line 16 and is received within the tank 7 for recycling.

Although reference has been made throughout the above described embodiment to a compressed gas cylinder clearly the method described would be suitable for cleaning the interior of any container which may be contaminated by oil or particulate materials.

A particular advantage of the above described method is that any leakage of carbon dioxide will have minimal effect on the environment when compared to the solvents and other cleaning materials currently used for cleaning compressed gas cylinders.

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CLAIMS

1. A method of cleaning the interior surface(s) of a container comprising passing clean liquid carbon dioxide under pressure through at least one nozzle located within the container.
2. A method as claimed in Claim 1, in which the clean liquid carbon dioxide from a source is first pressurised and then passed through a filter to remove particulate material therefrom prior to its passage through the or each nozzle.
3. A method as claimed in Claim 1 or 2, in which a plurality of nozzles are located within the container, said nozzles being spaced apart and extending substantially along the full length of the container.
4. A method as claimed in any one of Claims 1 to 3, in which the interior of the container is slowly pressurised to approximately 40 bar to inhibit coating effects and the formation of dry ice prior to the introduction of the clean liquid carbon dioxide.
5. A method as claimed in any one of Claims 1 to 4, in which after passage through the or each nozzle liquid carbon dioxide is withdrawn from the container and collected for reprocessing.
6. A method of cleaning the interior of a container substantially as hereinbefore described.